ON PENETRATING GUNSHOT WOUNDS OF THE ABDOMEN. AN EXPERIMENTAL STUDY AND CLINICAL REVIEW.

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NOW that the propriety of operative interference in the treatment of penetrating gunshot wounds of the abdomen is fairly settled, a natural demand addresses itself to the surgeon for the early establishment of such rules as offer the best success in the treatment of these injuries.

While the indications upon a whole may seem very plain, there are yet many questions and processes to be understood and decided, which time, research and experimentation can alone supply. An analysis of such cases and discussions as the current literature affords bears strong evidence in this direction, and until a more intimate knowledge of the details of the subject is at hand, our success must necessarily be limited. In view of this, a series of experimental operations were instituted by Dr. Ap Morgan Vance, and the author, with the hope of throwing additional light upon the subject, and although the desired end may not be found within the scope of this paper, it is hoped that it may be of some value as an additional contribution to that already at hand from Parkes, Senn, Bull, Stimson and others. Before entrance upon the subject proper, we take this occasion to extend our thanks to the hospital committee, Dr. J. L. Long, Mr. B. H. Lammers, now Dr. Lammers, and others, for valuable assistance rendered upon different occasions. The earlier and major portion of this work was done near the suburbs of the city, but upon the approach of winter was transferred to the Louisville City Hospital. The facilities afforded at either place were only ordinary, and especially at the latter, where several dogs that had been

operated upon and recovered, as well as one that was shot, and upon which no operation was performed, through a defective means of keeping, made their escape. The dogs were selected, regardless of their surroundings or conditions, and in several instances their deaths were apparently traceable to the undersize of the subject.

Shaving the field of operation and anæsthetizing constituted the only preliminary steps to which they were submitted previous to the shooting. In nearly every instance ether was the anæsthetic employed, five deaths occurring from the effects of the anæsthetic which are not hereafter mentioned in the experiments. Of these, with the exception of one or two, chloroform was employed, death occurring either before or during the earlier part of the operation. The shots were fired at a close range, and only such care exercised as to avoid the production of some irreparable injury, while they should still fairly present such cases as ordinarily fall into the hands of the surgeon.

The wounds were inflicted by a .22 and .32 calibre Smith & Wesson pistol and a .22 calibre Remington rifle, the projectiles used being floberts, .22 "shorts" and "longs" and .32. Comparing in size the abdominal viscera of an average full-grown dog with those of an adult human, about the same effect is obtained from the use of a .22 in a dog as that of a .32 or larger in a man.

The work was done as antiseptically as permissable. After shaving, the field was scrubbed with potash soap, followed by a 1:2000 sublimate solution, or a 5% solution of carbolic acid, and lastly bathed in a 10% ethereal solution of iodoform. During the progress of the operation the surrounding site was covered with towels, wrung out of a hot 1:2000 sublimate solution. Likewise upon the part of the operator suitable antiseptic precautions were employed. Successive baths of permanganate of potash, oxalic acid and hyposulphite of soda served for the preparation of the sponges. In those cases where cleansing of the abdominal cavity was indicated, flushing with warm Thiersch's solution or warm sterilized water was resorted to; otherwise the irrigator charged with Thiersch's solution answered the purpose. Catgut prepared

after the method of Kocher, and silk after that of Czerny, represented the materials used for sutures.

The dressings in common use did not prove to be of practical value here. After closure of the abdominal wound, which was done by the combined "mattress suture" and "glover's stitch," it was dusted with iodoform and a liberal application of liq. gutta percha used as the only dressing. The liq. gutta percha when made by reinforcing the U. S. P. preparation, with an additional one-third of its official amount of gutta percha furnished an admirable dressing, sealing the wound in a most thorough manner. As to the food, this in the beginning, for about a week subsequent to the operation, was restricted to that of a liquid character, but later such care was less and less observed, until finally almost ignored, and in one instance where a resection was done, by a mistake a large piece of raw meat was given but a few hours after the operation without any evil resulting. Such briefly represents the manner in which the experiments were carried on. Neither time nor space would permit here of even a brief review of the opinions and progress of the work done upon this subject.

Some General Considerations of the Nature of These Injuries.

Nowhere within the domain of surgery are the effects attending gunshot wounds more multiple and uncertain in their nature than those penetrating the abdominal cavity.

Even where some definite knowledge of the character of weapon and missile used and the circumstances under which the injuries were received are at hand, no safe conclusions can be reached as to the extent and course of the ball or the amount and character of damage it creates, since it is a well-known fact that even where projectiles are discharged under conditions as like as practicable, they will often differ widely in their energy and velocity. While it may be safely said that as a rule the extent of danger is more or less in direct ratio to the size of the ball, such a rule is by no means absolute. Numerous conditions, some of which apparently trivial in their